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(54) Anti-sputtercoating

(57) Unwanted sputtering of metal when a hole is being drilled by a laser beam in a metal component is avoided by coating the component with a water-soluble paste containing sodium silicate and a thixotropic filler such as bentonite. Subsequently, the paste is easily washed off with water.

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IMPROVEMENTS IN OR RELATING TO LASER DRILLING OF COMPONENTS

This invention concerns improvements in or relating to laser drilling of components. In particular, it relates to the laser drilling of cooling holes in nozzle guide vanes, turbine blades or similar components of an aircraft gas turbine engine which are subject to extreme heat when in use.

Such vanes or blades are provided with internal channels or cavities which communicate with the outside of the vane or blade by means of a plurality of cooling holes. The cooling holes are usually located along or adjacent an external edge of the vane or blade, but may also be found on external surfaces. In use, cooling air is passed through the channels and exits through the holes to flow over the edge or surface that is to be cooled, and thus enable the component to operate in a temperature environment that may be above the melting point of the metal of which it is made.

Each cooling hole, which typically is a fraction of a millimeter in diameter, is drilled through the metal of the vane or blade by means of a laser beam, in a manner known in the art. However, the laser beam, in drilling the hole, may cause sputtering of the metal and splashing of small quantities of molten metal over the component being drilled, especially when striking through into the internal channel. These splashes of metal may impede air flow either through the channel or over the external edge or surface, or may block some of the air cooling holes.

It is known to coat, prior to laser drilling, the

interior of a cavity in a vane or blade with an adherent coating such as PTFE. Such coatings are difficult to remove subsequently and usually involve the use of hazardous chemicals in a series of operations.

It is an object of the present invention to avoid the sputtering and splashing of the metal of the component being drilled by laser in a manner that is easy and economical to operate and which presents a minimum hazard to the operator.

According to a first aspect of the present invention there is provided a method of laser drilling a component so as to avoid sputtering of the material of the component, the method comprising forming an adherent coating on a surface of the component by applying to the surface a water-soluble paste containing as its active principle sodium silicate and permitting the paste to dry, drilling through the coating and the component with a laser beam to provide a hole through or into the component, and subsequently removing the coating.

The paste preferably also contains a thixotropic filler such as bentonite.

According to a second aspect of the invention there is provided a water-soluble anti-sputtering composition for application to a surface prior to laser drilling of the surface, the composition containing as its active principle sodium silicate.

The invention will now be described by with reference to the following non-limiting examples:

Example 1

An anti-sputter composition (composition "A") was prepared by mixing the following constituents,

sodium silicate soln	100 parts by weight
bentonite	22 parts by weight
wetting agent	1 part by weight

The sodium silicate solution was technical grade C112 made by Imperial Chemical Industries Plc and consisted of a 48.5% w/w solution of sodium silicate in water.

The bentonite (hydrated aluminium silicate) originate form Wyoming in Canada and was of grade -200 mesh to dust.

The wetting agent was Synperonic N made by Imperial Chemical Industries Plc and consists of a 25% w/w aqueous solution of a non-ionic surfactant.

Example 2

An anti-sputter composition (composition "B") was prepared by mixing the following constituents,

sodium silicate soln	100 parts by weight
bentonite	104 parts by weight
wetting agent	1 part by weight.

The constituents were of the same substance and qualify as in Example 1.

Example 3

An anti-sputter composition (composition "C") was prepared by mixing the following constituents,

sodium silicate soln	100 parts by weight
bentonite	104 parts by weight
wetting agent	1 part by weight.

The constituents were of the same substance and quality as in Example 1.

In experiments each anti-sputter composition A, B, C was applied in turn to a respective aircraft metal turbine vane by pasting, and allowed to dry. Holes were then laser drilled in each vane through its anti-sputter composition coating. The coatings were then washed off with pressurised jets of hot water, which process was carried out easily.

On inspection of the vanes it was seen that there was minimal sputtering of the metal surrounding the laser drilled holes.

Interior cavities of components may be similarly coated prior to laser drillng, but in these cases it may be necessary to dilute the anti-sputtering paste with water.

Composition ranges extending outside those exemplified may be used within the scope of the invention.

The examples show that the composition of the invention is easily applied to a component before laser drilling, and is equally easily removed after drilling by the application of pressurized hot water. The composition of the invention further has low toxicity and cost, is nonflammable, and gives low

contamination of the final product.

CLAIMS

1 A method of laser drilling a component so as to avoid sputtering of the material of the component, the method comprising forming an adherent coating on a surface of the component by applying to the surface a water-soluble paste containing as its active principle sodium silicate and permitting the paste to dry, drilling through the coating and the component with a laser beam to provide a hole through or into the component, and subsequently removing the coating.

2 A method as claimed in claim 1 wherein the paste contains a thixotropic filler.

3 A method as claimed in claim 2 wherein the paste contains 15 - 55% by weight of filler.

4 A method as claimed in claim 2 wherein the filler is bentonite.

5 A method as claimed in claim 1 wherein the paste contains a wetting agent.

6 A method as claimed in claim 1 wherein the subsequent removal of the coating is by means of the application of water.

7 A method as claimed in claim 1 wherein the material of the component is a metal.

8 A water-soluble anti-sputtering composition for application to a surface prior to laser drilling

of the surface, the composition containing as its active principle sodium silicate.

9 A composition as claimed in claim 8 wherein the composition is in the form of a paste when applied.

10 A composition as claimed in claim 8 wherein the composition contains a thixotropic filler.

11 A composition as claimed in claim 10 wherein the filler is 15 - 55% by weight of the composition.

12 A composition as claimed in claim 10 wherein the filler is bentonite.

13 A composition as claimed in claim 8 including a wetting agent.

14 A method of laser drilling a component so as to avoid sputtering of the material of the component substantially as hereinbefore described with reference to the examples.

15 A water-soluble anti-sputtering composition for application to a surface prior to laser drilling of the surface substantially as hereinbefore described with reference to the examples.

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